

Standard Form vs. Vertex Form

Standard Form of a Quadratic: $y = ax^2 + bx + c$

Examples: $y = x^2 - 3x - 4$ or $y = 2x^2 + 13x + 6$

Vertex form of a Quadratic: $y = a(x-h)^2 + k$

Examples: $y = (x+2)^2 - 7$ or $y = -\frac{1}{2}(x-3)^2 + 5$

1.) Axis of Symmetry - line that divides the parabola into 2 mirror images

x value of vertex
Standard Form: $x = \frac{-b}{2a}$
Vertex Form: $x = h$

2.) Vertex - intersection of the parabola and the line of symmetry

point
Standard Form: $(-\frac{b}{2a}, \text{plug in for } x \text{ to get } y)$
Vertex Form: (h, k)

3.) Direction of Opening:

If $a > 0$, then parabola opens up and vertex is a minimum
If $a < 0$, then parabola opens down and vertex is a maximum

4.) Y-intercept - intersection of the parabola and the y-axis

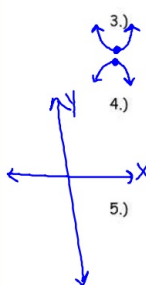
Steps for the y-intercept and reflection point

make $x = 0$ and solve for y .

5.) X-intercept - intersection of the parabola and the x-axis

Steps for the x-intercept and reflection point

make $y = 0$ and solve for x



standard Example 1: Graph $y = x^2 + 6x + 8$

$a = 1$ $b = 6$ $c = 8$

x value of vertex
1.) Axis of symmetry $x = -3$
 $-\frac{b}{2a} = \frac{-6}{2(1)} = -3$

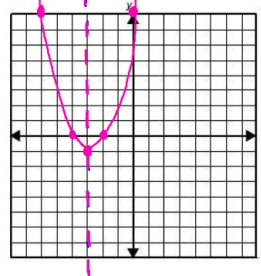
point
2.) Vertex $(-3, -1)$
 $(-3)^2 + 6(-3) + 8 = -1$
 $9 - 18 + 8 = -1$

3.) Direction of Opening: up $a > 0$

point
(x, y)
4.) Find the y-intercept
(x = 0) $(0)^2 + 6(0) + 8 = 8$
 $(0, 8)$

points
5.) Find the x-intercept
(y = 0) $0 = x^2 + 6x + 8$
 $0 = (x+4)(x+2)$
 $x+4=0$ $x+2=0$
 $x=-4$ $x=-2$
 $(-4, 0)$
 $(-2, 0)$

$y = (x+3)^2 - 1$



vertex Example 2: Graph $y = (x-2)^2 + 5$

$a = 1$ $h = 2$ $k = 5$

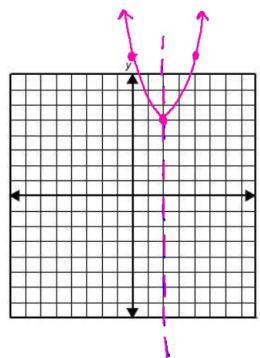
x value of vertex
1.) Axis of symmetry $x = 2$

2.) Vertex $(2, 5)$
 (h, k)

3.) Direction of Opening: up $a > 0$

point
4.) Find the y-intercept
(x = 0) $(0-2)^2 + 5 = 9$
 $4 + 5 = 9$
 $(0, 9)$

5.) Find the x-intercept
(y = 0) $0 = (x-2)^2 + 5$
 $\sqrt{-5} = \sqrt{(x-2)^2}$ $x = 2 + \sqrt{-5}$
 $\sqrt{-5} = x - 2$ (none) does not exist



standard

Example 3: $y = x^2 - 4x - 12$

$a=1$ $b=-4$ $c=-12$

1.) Find axis of symmetry: $-\frac{b}{2a}$

$x=2$

$x = \frac{-b}{2a} = \frac{4}{2} = 2$

2.) Find the vertex.

$(2, -16)$

$(-\frac{b}{2a}, \text{plug in})$ $(2)^2 - 4(2) - 12$
 $4 - 8 - 12 = -16$

3.) Direction of Opening: $\text{up } a \oplus$

4.) Find the y-intercept

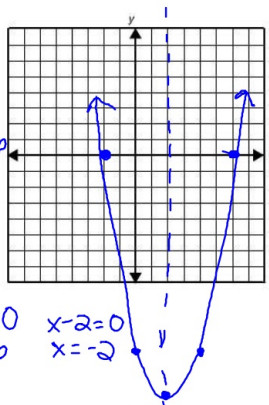
$(0, -12)$

$(x=0)$ $0^2 - 4(0) - 12$
 $(0, -12)$

5.) Find the x-intercept

$(6, 0)$
 $(-2, 0)$

$(y=0)$
 $0 = x^2 - 4x - 12$ $x-6=0$ $x-2=0$
 $(x-6)(x+2)$ $x=6$ $x=-2$



vertex

Example 4: $y = 2(x-1)^2 - 8$

$a=2$ $h=1$ $k=-8$

1.) Find axis of symmetry: $x=h$

$x=1$

$x=1$

2.) Find the vertex.

$(1, -8)$

(h, k) $(1, -8)$

3.) Direction of Opening: $\text{up } a \oplus$

4.) Find the y-intercept

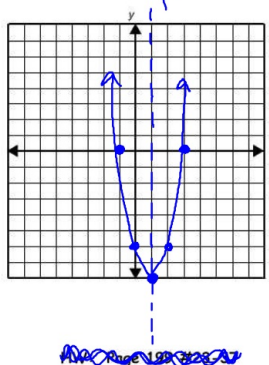
$(0, -6)$

$(x=0)$
 $y = 2(0-1)^2 - 8$
 $(0, -6)$

5.) Find the x-intercept

$(3, 0)$
 $(-1, 0)$

$(y=0)$
 $0 = 2(x-1)^2 - 8$
 $8 = 2(x-1)^2$
 $\frac{8}{2} = (x-1)^2$
 $\sqrt{4} = (x-1)$
 $2 = x-1$
 $x=3$



Winter Break packet
due tomorrow
Jan. 4th

